SUBSTITUTE SPECIFICATION
(Clean Copy)

METHOD AND APPARATUS FOR PROCESSING SIGNALING INFORMATION IN TELECOMMUNICATIONS NETWORK

CLAIM FOR PRIORITY

This application claims priority to International Application No. PCT/DE00/02860 which was published in the German language on March 8, 2001.

TECHINCAL FIELD OF THE INVENTION

The invention relates to a method for processing signaling information in a telecommunications network method.

BACKGROUND OF THE INVENTION

In an analog telephone network, the signaling is carried out inband before the actual communication. That is, while the connection is being set up. During communication, signaling can be initiated by means of a hook flash, i.e. an interruption in the communication. In this case, the switching center detects that the communication link has been interrupted and signaling is desired. The switching center then connects a code receiver, for evaluating the signaling, into the connection.

The signaling information is used, for example, for initiating telecommunications services such as call-back, broker calls or call forwarding. These telecommunications services are carried out by software which is used in the switching center and runs on servers in the switching center. In order to introduce new telecommunications services, the software must be modified and must be reloaded onto the servers. However, this means interrupting the operation of the telecommunications services in the switching center for the time during which the modified software is being loaded. A further disadvantage is that any modification to the software running on the servers requires specific programming knowledge in the programming language in which the software is written. This is

because the programming languages which are used for this purpose are generally machine-level programming languages, so that any modification to programs written in these programming languages is very complex.

SUMMARY OF THE INVENTION

In one embodiment of the invention, there is a method for processing signaling information in a telecommunications network, comprising: interchanging signaling information between a subscriber terminal and a switching center; converting the signaling information being converted in the switching center to at least one message which is transmitted to at least one telecommunications service server which is connected to the switching center; and with the telecommunications service wherein; server carrying out the telecommunications services corresponding to the message is transmitted via the Internet to an Internet server.

In one aspect of the invention, the signaling information is control information for the ISDN D channel protocol, and the control information is interchanged via a D channel between the subscriber terminal and the switching center, with the control information having ISDN service information for at least one ISDN service, which information is converted in the switching center into messages and is transmitted to at least one ISDN D channel server which is connected to the switching center and corresponds to the telecommunications service server, and with the ISDN D channel server carrying out the ISDN service or services corresponding to the messages.

In another aspect of the invention, the telecommunications service server has a number of program routines for carrying out a number of telecommunications services.

In still another aspect of the invention, the telecommunications service server carries out switching telecommunications services, the switching telecommunications services expanding the telecommunications services which are carried out by the switching center.

In yet another aspect of the invention, the telecommunications service server carries out subscriber-specific or national-specific telecommunications services.

In another embodiment of the invention, there is an apparatus for processing signaling information in a telecommunications network, comprising: a controller to transmit, receive and process the signaling information and connected to a server in a switching center, the controller having a device to convert received signaling information, which relates at least to one telecommunications service, into messages, and having an interface to connect at least one telecommunications service server to the switching center, the telecommunications service server configured for carrying out the telecommunications service, wherein the telecommunications service server is an Internet server, which is connected to the Internet.

In one aspect of the invention, the signaling information is control information for the ISDN D channel protocol, and the controller transmits and receives control information via a D channel, the interface configured for connecting at least one ISDN D channel server as a telecommunications service server.

In another aspect of the invention, the telecommunications service server has an interface for connection to the switching center the interface receiving messages from the switching center and calling telecommunications services, which correspond

to the messages, on the telecommunications service server.

In still another aspect of the invention, the ISDN D channel server carries out the ISDN services corresponding to the control information.

BRIEF DESCRIPTION OF THE DRAWINGS

Further advantages and application options of the invention will be explained in the following text with reference to the exemplary embodiments of the invention using ISDN, and in conjunction with the drawings, in which:

Figure 1 shows a block diagram in which an ISDN subscriber terminal is connected to an ISDN switching center and an ISDN D channel server is connected to the ISDN switching center, in order to carry out ISDN services.

Figure 2 shows the transmission of a D channel protocol between a first subscriber terminal, via an ISDN switching center, and a second subscriber terminal.

Figure 3 shows an ISDN D channel server being linked, as an Internet server, to an ISDN switching center.

DETAILED DESCRIPTION OF THE PREFFERED EMBODIMENT

Signaling information is transmitted between a subscriber terminal and a switching center in a telecommunications network either inband, that is to say within the channel provided for the user data, or outband, that is to say in a signaling channel provided exclusively for this purpose.

In the ISDN (Integrated Services Digital Network), for example, outband signaling is provided via the D channel.

The present invention discloses a method and an apparatus for processing signaling information in a telecommunications network, which also allows the introduction of new telecommunications services in addition to those provided by a switching center without any modification to programs installed on servers in the switching center.

In one embodiment of the invention, there is a method for processing signaling information in a telecommunications network. A switching center interchanges signaling information with a subscriber terminal. The signaling information is converted in the switching center to at least one message, which messages are transmitted to at least one telecommunications service server which is connected to the switching center, with the telecommunications service server or servers carrying out the telecommunications service or services corresponding to the messages.

The method according to the invention advantageously allows telecommunications services to be introduced without any amendment to the programs running on the servers in the switching center. That the telecommunications service servers which form an external expansion of the switching center, carry out the telecommunications services. To do this, the signaling information which is received by the switching center is passed on to the additional telecommunications service servers. According to the invention, this is done by converting the signaling information to messages, which are passed on to the telecommunications service server or servers. For example, the messages may be converted to an appropriate protocol for interchanging data between the switching center and the telecommunications service servers. New telecommunications services can thus be retrofitted simply by means of additional telecommunications service server applications. For

example, telecommunications services such as call forwarding or outgoing call barring can be implemented on a telecommunications service server. Furthermore, telecommunications services can be introduced irrespective of the manufacturer of the switching center.

As in a computer network, the process of linking a number of telecommunications service servers to the switching center makes it possible to distribute the computation load from the telecommunications services between the telecommunications service servers. The local processing of the telecommunications services in the switching center is thus partially moved by the invention to one or more telecommunications service servers. The telecommunications service server or servers may preferably be in the form of an Internet server or servers, and can receive and transmit messages using the Internet protocol format. The subscriber terminal may be, in particular, a telephone, fax or modem, or else a network termination which has intelligent functions for signaling.

It is preferable for the telecommunications service server or servers each to have a large number of program routines for carrying out a number of telecommunications services, with the program routines being written in a relatively high level programming language. Telecommunications services can thus be introduced or amended particularly easily, since the program routines, which are written in the relatively high level programming language, just need to be reprogrammed on the telecommunications service server or servers. Since the program routines are written in a relatively high level programming language, amendment requires less effort, and is thus cheaper, than amendment of machine-level programs in the switching center.

The telecommunications service server or servers preferably carry out switching telecommunications

services, with the switching telecommunications services expanding the switching services which are carried out by the switching center. Additional switching services can thus be introduced quickly and flexibly by means of the telecommunications service servers.

The telecommunications service server or servers preferably carry out subscriber-specific or national-specific telecommunications services. For example, a subscriber may request additional telecommunications services, which are then enabled simply by providing additional program routines, or by expanding existing program routines, on the telecommunications service server or servers for that subscriber. The switching center handles those telecommunications services which are the same for the subscribers. Additional services, which are desired by the subscriber, are, in contrast, provided by the program routines on the telecommunications service server or servers. Furthermore, it is easier to test whether new telecommunications services gain acceptance with the customers for those services, since the software in the telecommunication service servers have the new services added to it, before or instead of having to integrate the services in a complex manner in the switching center software. Alternatively, the telecommunications services carried out by the program routines may also have national-specific telecommunications services. In this case, it is particularly advantageous for the switching center to carry out only telecommunications services which are independent of the state, that is to say telecommunications services which are the same in all states, and for the national-specific telecommunications services to be carried out by means of appropriate program routines in the telecommunications service server or servers. The switching center can thus be used throughout the world irrespective of national-specific telecommunications services. The national-specific telecommunications

services are provided by appropriate telecommunications service server programs.

It is preferable for the method to be used with ISDN. The signaling information is then control information for the ISDN D channel protocol, and the control information is interchanged via a D channel between the subscriber terminal and the switching center. The control information has ISDN service information for at least one ISDN service, which information is converted in the switching center to messages and is transmitted to at least one ISDN D channel server. It is then connected to the switching center and corresponds to the telecommunications service server, and with the ISDN D channel server or servers carrying out the ISDN service or services corresponding to the messages.

In another embodiment, there is an apparatus for processing signaling information in a telecommunications network. The apparatus includes, for example, a controller being provided for transmitting, receiving and processing the signaling information in a switching center and being connected to a server in the switching center. According to the invention, the controller has a device for converting received signaling information, which relates at least to one telecommunications service, into messages, and has an interface for connecting at least one telecommunications service server to the switching center, with the telecommunications service server or servers configured for carrying out the telecommunications service or services.

Each telecommunications service server preferably has an interface for connection to the switching center, with the interface receiving messages from the switching center and calling telecommunications services, which correspond to the messages, on the telecommunications service server or servers.

In one aspect refinement of the invention, the telecommunications service servers are Internet servers, which are provided for processing telecommunications services. This makes it possible to use IP telephony (Internet Protocol telephony).

The apparatus is preferably used in the ISDN. The signaling information is then control information for the ISDN D channel protocol, and the controller transmits and receives control information via a D channel, with the interface being used for connecting at least one ISDN D channel server as a telecommunications service server. The ISDN D channel server or servers preferably carries out or carry out ISDN services corresponding to the control information.

In Figure 1, an ISDN subscriber terminal 10 is connected to an ISDN network termination 1 via zero bus 11. The ISDN network termination 1 is in turn connected to a digital ISDN switching center 5. A D channel 2 and two B channels 3 and 4 are provided between the ISDN switching center 5 and the ISDN network termination 1. The ISDN switching center 5 and the ISDN network termination 1 interchange signaling information via the D channel 2 using the DSS1 protocol (Digital Signaling System 1 Protocol) in accordance with ITU Recommendation Q.950. The signaling information which is interchanged via the D channel 2 is used, for example, to set up a connection between two subscribers, to clear an existing connection or to initiate various ISDN services such as a conference circuit, callback or call forwarding. For call forwarding, for example, a subscriber uses his terminal to signal to the ISDN switching center 5 that incoming calls to the subscriber number corresponding to the subscriber terminal 10 should be passed onto a second subscriber number. The signaling which is for this purpose entered by the subscriber via the subscriber terminal 10 is transmitted as signaling information via the D channel 2 to a D channel controller 7 for

transmitting, receiving and processing the ISDN D channel protocol in the ISDN switching center 5. The D channel controller 7 is coupled to an ISDN server 8 in the ISDN switching center 5. A program for processing the signaling information in the ISDN D channel protocol and for carrying out corresponding ISDN services runs on the ISDN server 8. The two B channels 3 and 4 are used in a B channel processing device 6 in the ISDN switching center 5, and are used for transmitting data and/or voice.

The D channel controller 7 has a device 13 for converting control information received via the D channel, and has an interface 12 for connection of at least one ISDN D channel server 9. The device for converting control information received via the D channel converts control information and signaling information in the D channel protocol to messages which are transmitted via the interface 12 to the ISDN D channel server or servers 9.

Program routines for carrying out ISDN services such as call forwarding, outgoing call bearing, or message waiting indication are provided on the ISDN D channel server or servers 9. The program routines which are provided on the ISDN D channel server or servers 9 have been developed in a relatively high level programming language, such as C or C++. Each of the ISDN D channel servers 9 has an interface for receiving messages from the D channel controller 7 in the ISDN switching center 5. The messages received by the interface of the ISDN D channel server 9 are used to carry out an appropriate program routine for an ISDN service. Outputs produced by the program routine are in turn converted by the interface of the ISDN D channel server 9 to messages, and are transmitted to the D channel controller 7 in the ISDN switching center 5. In the ISDN switching center 5, the received messages in the D channel controller 7 are received by the interface 12, are converted to corresponding control and signaling

information using the D channel protocol, and are transmitted via the D channel 2 to the ISDN network termination 1.

Figure 2 shows the protocol architecture for transmitting control information via the D channel.

A first subscriber terminal 50 is connected to a first digital ISDN switching center 52 via a first D channel 55. A second subscriber terminal 54 is connected via a second D channel 57 to a second digital ISDN switching center 53. The first ISDN switching center 52 and the second ISDN switching center 53 are connected to one another via a signaling line 56, via which protocols which are specific to the switching center are transmitted in accordance with the ITU-T No. 7 signaling system.

The OSI specification layers 1 to 3, which are used for the D channel protocol, are shown in the first subscriber terminal 50 and in the second subscriber terminal 54. The OSI specification layers 1 to 3 are likewise shown in the first switching center 52 and in the second switching center 53, on the side which is connected to the first subscriber terminal 50 and to the second subscriber terminal 54, respectively. The higher layers 4 to 7 (application-oriented layers) from the OSI specification have an end-to-end significance for the transmission of control information in the D channel. These protocols are interchanged directly between the subscriber terminals, transparently via the ISDN network.

The first ISDN switching center 52 is connected to an ISDN D channel server 51, which receives signaling information in the D channel protocol from the first ISDN switching center 52, and evaluates this signaling information. Programs for carrying out ISDN services are stored in the ISDN D channel server 51. The ISDN D channel server 51 starts a program for carrying out an

ISDN service in accordance with the received control information. The first ISDN switching center 52 is thus relieved of the load of handling specific ISDN services, which are processed by the ISDN D channel server 51. Furthermore, ISDN services which are either subscriber-specific or national-specific or are intended to be introduced for the first time can be carried out by the ISDN D channel server 51. Thus, as already described above, the software in the first ISDN switching center 52 need not be amended in order to introduce new ISDN services, and amendments do not interrupt the operation of the first ISDN switching center 52. The process of linking a number of ISDN D channel servers to the first ISDN switching center 52 allows the load produced by the additional ISDN services to be distributed between these servers, as in a computer network. Additionally, this allows the capacity for additional ISDN services to be extended by linking additional ISDN D channel servers to the first ISDN switching center 52. For example, it is possible to provide special ISDN D channel servers for routing service requests to appropriate ISDN D channel servers (an MWI server routes a call forwarding service request to the ISCI server, which carries out that service).

The use of the method and of the apparatus according to the invention is not restricted to ISDN switching centers, but can also be used in private ISDN telecommunications systems. For example, an ISDN telecommunications system can be connected to a computer, which carries out additional ISDN services which are not provided by that ISDN telecommunications system. The ISDN telecommunications system then transmits the signaling information of the D channel (as in the case of the ISDN switching center) to the computer, using the method according to the invention. The computer then carries out those ISDN services which correspond to the transmitted signaling information in the D channel, and relieves the load on the ISDN telecommunications system. The fundamental principle of

the ISDN telecommunications system therefore does not differ from that of an ISDN switching center.

Figure 3 shows the use of an ISDN D channel server as an Internet server.

A large number of subscriber terminals 100 and 101 are connected to an ISDN network termination 103 via an S0 bus 102. Two B channels 105 and one D channel 104 are provided for transmitting signals between the ISDN network termination 103 and an ISDN switching center 106.

The ISDN switching center 106 is connected to the public telephone network 107 for voice and data transmission between subscribers.

The ISDN switching center 106 is connected via an Internet link 109 to a first Internet server 110, which operates as an ISDN D channel server. The first Internet server 110 is connected to the Internet 108, and is connected to a large number of further Internet servers 111 via the Internet 108.

If a subscriber terminal 100 or 101 now requests an ISDN service which is processed by an ISDN D channel protocol server, then the service request is transmitted via the D channel 104 to the ISDN switching center 106. The ISDN switching center 106 then converts the received service request to a message in the Internet protocol format, and transmits this message via the Internet link 109 to the first Internet server 110. The first Internet server 110 then processes the received message, and carries out the ISDN service corresponding to it. If a response is produced to this, the first Internet server 110 passes this response back via the bidirectional Internet link 109 to the ISDN switching center 106. If, for example, a subscriber wishes to use his ISDN subscriber terminal to make an IP telephone call (Internet protocol telephone call),

then he can signal the request for an ISDN service "IP telephone call" to the ISDN switching center 106 via the D channel 104. The ISDN switching center 106 then transmits the service request via the Internet link 109 to the first Internet server 110, which in turn sets up an IP telephone call connection via the Internet.

Although the exemplary embodiments describe the use of the invention with ISDN, the invention, in accordance with the claims, is not restricted to ISDN. The invention can be used just as well in an analog telephone network or in IP-based/packet-switching networks. Anyone skilled in the art will immediately be familiar with the modifications required to the invention for this purpose. All the parts and method steps described above are claimed as being significant to the invention not only in their own right but also in any combination, in particular the details illustrated in the drawings. Appropriate modifications therefrom are familiar to anyone skilled in the art.